# EXHIBIT D

# DECLARATION OF LAWRENCE STILWELL BETTS, MD, PhD

I, LAWRENCE STILWELL BETTS, declare and state as follows:

1. My name is Lawrence Stilwell Betts, MD, PhD, CIH, FACOEM. I am a retired United States Navy Captain with a very active professional practice based in Poquoson, Virginia. As reflected in my Curriculum Vitae (Exhibit A), I am the President of a medical corporation that is based upon applying the principles and methods of preventive medicine. I routinely integrate and apply occupational and environmental medicine, toxicology, and industrial hygiene to consult or work with difficult or complex medical cases where treatment, or exposure, or possible consequences of exposure, is in question. However, the emphasis of my entire career has been the prevention of illness and the promotion of health through the application of the professional tools of my scientific and medical knowledge and experience. I served in the US Navy from 1972 until 2001. After my retirement from the Navy, I was presented the VADM Richard A. Nelson Award for my career contributions to Navy and Marine Corps readiness through leadership in prevention of disease and promotion of health. My professional practice still includes working with the Navy and other military services, as well as non-military federal agencies, industry, professional organizations, and academically- and privately-practicing professionals. In addition to performing recurrent consultations, I teach, mentor, conduct research, develop prevention and treatment protocols, and write medical articles and text chapters. I am a Professor at the Eastern Virginia Medical School in the Department of Family and Community Medicine and a Clinical Professor in the Department of Physiological Sciences. I serve on several national committees addressing broad, as well as, specific issues in occupational and environmental health. I am board certified in Occupational Medicine by the American Board of Preventive Medicine, and in the comprehensive practice of Industrial Hygiene by the American Board of Industrial Hygiene. I am one of the three "medical scientists" who have ever been elected to Fellowship in both the American College of Occupational Medicine and the American Industrial Hygiene Association. In the practice and application of

toxicology, it is well known that ALL chemicals are toxic as a consequence of dose (Paraselsus [1493-1541]: "Sola dosis facit venenum"—"Dose alone makes the poison") and that "hazard" is a consequence of how a chemical is used. The anticipation, recognition, evaluation, and control of hazardous conditions are the fundamentals of industrial hygiene and my practice of preventive medicine and public health.

2. During my Navy career, I had experiences ranging from the provision of "field" services underway and on shore as a junior industrial hygiene officer, to the oversight of the medical and scientific aspects of a robust occupational health program as a senior Navy officer. I have spent time at sea on a number of United States Navy and United States Naval ships. I served as a physician on the USS KITTY HAWK (CV-63) during its Service Life Extension Program (SLEP) in the Philadelphia Naval Shipyard from 1987 to 1989. My experiences and training enabled me to become qualified as a Surface Warfare Medical Department Officer. Based upon my scientific and medical training, and experience as a Navy officer for three decades, I am generally familiar with the industrial products and equipment that were used by the Navy and the Navy work environments, both ashore and afloat. I am also familiar with the history and practice of the Navy occupational health program from its early days before World War II until the present time.

3. I have been asked to address three questions: (1) What did the United States Navy know regarding the health hazards associated with the use of asbestos during the period from World War II until the promulgation of the first nation-wide legislation on occupational health and safety (PL 91-596; Occupational Safety and Health Act of 1970); (2) Were there any dangers related to the use of asbestos-containing insulation products manufactured by others and applied by others on General Electric marine steam turbines on United States Navy ships that were known to General Electric but not to the United States Navy; and (3) Did Navy specifications and instructions support the notion that manufacturers of equipment were free to provide unsolicited warning information about hazards of products they did not manufacture or supply?

4. In addressing these questions, I have relied upon my personal and professional

knowledge and experience as an industrial hygienist, toxicologist, and occupational medicine physician; my operational and industrial experiences from my total Navy career; my review of historical documents regarding the Navy's knowledge as well as the scientific and medical communities' knowledge of the hazards of asbestos; and my own experiences, research, and numerous communications with workers and service members, industrial hygienists, and physicians who worked for the Navy and the Public Health Service dating back to the 1940s.

5. The Navy's use of asbestos aboard ships and on turbines was not by chance or based on any requirements of General Electric. The use of asbestos was based upon military necessity. As discussed in their landmark paper addressing the use of asbestos in the Navy, Fleisher and coworkers state:

> "An important ingredient of pipe covering material used on U.S. Navy vessels is amosite . . . The chief reasons for the wide use of amosite felt and pipe covering in naval work are its low thermal conductivity, light weight, strength and refractoriness. When the felt and pipe covering were first developed, we were still building vessels under the Washington Treaty of Limitations in Tonnage, and every pound saved meant that much more armor, guns or ammunition for a given displacement, to say nothing of more economic operation for the weight involved in insulation.
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> Amosite pipe covering weights about 14 pounds per cubic foot, with a temperature limit of 750 F, as compared to magnesia with a weight of 16 pounds per cubic foot, and a temperature limit of 500 F, High temperature amosite pipe covering weights about 18 pounds per cubic foot as compared to 26 pounds per cubic foot for other high temperature insulations. Because of the lower conductivity and the higher temperature limit of the amosite type, less of it need be used in combination covering than other types of insulations.
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> The development of amosite felt started in 1934 when a need existed to secure a thermal insulation lighter in weight and thermally more efficient than the materials (blocks and cement or asbestos blankets) which were then being used on destroyer turbines. The Navy approved the type developed by a manufacturer in September, 1934. Originally amosite was used only for turbine insulation, but it proved so satisfactory that its field of application enlarged to include insulation of valves, fittings, flanges, etc. From the initial destroyer, it has been used on almost all the destroyers built since that time and on all other combat vessels built since before the War.
>
> Pipe covering was a later development in late 1935 and early 1936. Due to the manufacturing problems involved, it took a longer time to evolve into a satisfactory shape, and its first use on naval vessels was in 1937. Since that time its use has spread markedly and it was used on the great majority of naval combat vessels built during World War II.
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> Water-repellent amosite felt was developed during the early part of 1942, as a

replacement for hair felt in the insulation of cold water lines to prevent sweating. Hair felt had the disadvantage of being combustible and as it was organic, when it became wet it molded or rotted and could harbor vermin. At this time fires on board certain naval vessels convinced the Navy of the desirability of eliminating any combustible material from on board ship. Eventually water-repellent amosite was made in strips of 50 foot lengths and of suitable width to enclose the circumference of the pipe and enclosed in an extremely light-weight muslin to facilitate handling and reduce the dust, which the water-repellent agent accentuated." (Fleischer-Drinker, 1945) (Exhibit B).

6. Indeed, the United States Navy specified who was responsible for furnishing and installing thermal insulation and lagging on turbines. The turbine manufacturer specified neither the type of insulation nor the lagging on the turbine. The turbine manufacturer was not responsible for furnishing or installing the thermal insulation or lagging on the turbine. The final inspection of the insulation product had nothing to do with the turbine manufacturer as stated in the 1955 military specification for turbines:

"3.4.8 Heat insulation and lagging.- Heat insulation and non-metallic lagging will be furnished by the shipbuilder." (Military Specification – Turbines, Steam, Propulsion – Naval Shipboard (MIL-T-17600A (SHIPS) (Exhibit C)).

7. The United States Navy recognized that the inhalation of asbestos fibers in sufficient amounts (dose = concentration x time) could result in pulmonary disease since at least the early 1920s and had an active program to identify hazardous exposures and control recognized health effects. In the "Instructions to Medical Officers" (Notes on Preventive Medicine for Medical Officers, United States Navy (Dublin, 1922) (Exhibit D)), asbestos was listed as one of the many inorganic and organic dusts that could cause pulmonary disease. Dublin recognized several methods to prevent the inhalation of these dusts including: the use of water to control the release of dust; the use of local exhaust systems to remove the dust at the point of origin; the use of inclosing (sic) chambers; and the use of respirators and helmets. He stated: "No one of these can apply to all conditions, but the particular method to be used must be adapted to the peculiarities of the process." From the extensive list of inorganic, as well as organic, dusts and "occupations which offer such exposure," it is obvious that his perception of dust control was based upon the avoidance of recognizable disease, and not the mere presence of a given, or visible, amount of dust being generated.

8. The United States Navy expanded the scope of its asbestos hazard control program by including the enlisted corpsmen of the medical department in the hazard control process. In the **Handbook of the Hospital Corps**, United States Navy, 1939 (Exhibit E), the Bureau of Medicine and Surgery discussed the organization used for disease and injury prevention in the United States Navy, and took a lead position in the prevention of industrial diseases:

> "The government having passed such laws must therefore lead the way in protecting its own employees . . . . An organization has been set up in the Navy to protect its personnel, both civilian and naval a safety engineer is provided, who acts directly under the Assistant Secretary of the Navy. He has supervision of the safety precautions taken to protect the civilian employees in the navy yards, ammunition depots, torpedo stations, and the like. He is also a consultant in all matters pertaining to safety aboard ships, at training stations and other Navy Department activities. A naval medical officer is assigned to his office for the purpose of consultation in all matters pertaining to health and safety and to cooperate in devising means by which health may be protected and accidents prevented. Aside from this particular medical officer, all medical officers, dental officers, members of the Hospital Corps and nurses form the balance of the medical staff of this organization. It is essential that each of these members know and understand the hazards to be encountered in the Navy, the steps to be taken to protect against injury and disease, the treatment of diseases and injuries arising therefrom and the organization of medical personnel for such purposes. Naval medical personnel are required to perform duties ashore, at sea, in foreign countries, in the air and under the sea. In each of these places a variety of health hazards exist. It is therefore necessary that this personnel have a thorough knowledge of the industry to which they are attached, the hazards presented, the methods of prevention and the treatment of all injuries occurring."

> "In all navy yards, the Commandant is the head of the organization. He is responsible to the Navy Department for the protection of the employees, as well as the naval personnel, under his command. He is familiar with the nature of the work being performed by the employees at his station and on the health and accident hazards presented. Accordingly, he appoints, as the working head of the organization, a safety officer or a safety engineer, as he is better known. The safety engineer must be of sufficient rank to have become familiar with the various trades in a navy yard, a knowledge of machinery, a man of cooperative ability and well liked, and having sufficient knowledge of safety devices and appliances to intelligently make inspections and recommend proper protective measures. His duties are primarily, to prevent accidents and promote healthy working conditions. It is his duty to inspect all working places, make a general survey of all mechanical conditions and to recommend the addition of all necessary safety appliances for the protection of the workers."

> "The Commandant further assigns a medical officer to act as advisor to the safety engineer. The medical officer must be of the same qualifications as the safety engineer, with the addition that he must be thoroughly versed in the diseases connected with Industry . . . . It is well for members of the Hospital Corps to understand the nature of these duties in order that they may be of assistance to him

> in the performance of these duties: . . . He acts as consultant to the safety engineer in all matters pertaining to the general welfare and health of the employees. Hygiene and sanitation are his important duties. He must interest himself in the employees and instruct them in the everyday principles of personal hygiene and self preservation. He must instruct the employees in safety measures and encourage them to cooperate in protective measures. They must be made "safety conscious" or "safety minded." The morale must be kept up . . . ."
>
> "The medical officer must inspect all working places in order to have a better understanding as to the actual conditions under which the men work . He must make appropriate recommendations to improve deficiencies noted and must then see that these recommendations are carried out."

The text further notes that the safety engineer is assisted by other personnel:

> "The safety engineer is assisted in his work by the foremen of the shops and in some instances by safety committees in each shop elected by the employees. These men or committees are generally chosen from among the older employees and from men who have considerable experience in their trade . . . . The organization of the medical advisor is composed of junior medical officers, dental officers, to some extent, members of the Hospital Corps, and of nurses. The duties of the hospital corpsmen are to assist the medical officer in his inspections, assist in the treatment of the injured and to prepare the necessary reports and returns in cases of accident, occupational disease, and the physical examination of employees."

A similar organization is described for "a battleship or in other places." To this end, the enlisted Hospital Corpsmen were informed of the hazards presented by asbestos and instructed to "locate these hazards and afford protection accordingly." Two of the hazards that the hospital corpsmen were specifically instructed to evaluate in a questionnaire (inspection or survey form) are:

> "What precautions are exercised to prevent damage from pipe covering compounds?"
>
> "What asbestos hazards exist?"

Also, the hospital corpsman was instructed to help keep the workforce healthy:

> "Proper working places must be provided and maintained Hygienic and sanitary conditions must be kept on a high plane. All moving parts of machinery must be guarded, goggles provided for workers required to use them; helmets and masks for sand blasters; proper ventilation for the chrome workers; masks for asbestos workers; protection for workers in x-ray and radium; protective gloves, shoes, and other garments for foundry workers, and other means of protection too numerous to mention here must be available and used. Special physical examinations must be made of all sand blasters, asbestos handlers, those exposed to radium and its compounds, lead workers, those engaged in dusty or smoky trades, handlers of T.N.T. and other explosives, etc., to prevent the occurrence of the diseases associated with those trades from injuring the men."

9. This type of active assessment, evaluation, and recommendation for control was embraced by senior United States Navy officers. In his memorandum to the Manager of the Navy Yard, Boston, CAPT H.E. Jenkins, MC, USN (1939) (Exhibit F) discussed his findings and recommendations from his survey of the pipe covering shop and work shack at that yard. Although he stated that the health hazards to personnel were very remote, based upon his evaluation of the amount of dust released, Captain Jenkins recommended that a dust respirator and gloves be worn to supplement the "conscientiously and intelligently enforced" practice of wetting down insulating material. Captain Jenkins also addressed the impractical use of respirators during shipboard lagging operations and recommended sufficient wetting to prevent dust generation as far as practicable. Less than one week later, C.D. Headlee (1939), issued a Production Division Notice [Number 996] (Exhibit G) implementing these recommendations.

10. Captain E.W. Brown (1941), in the *Annual Report of the Surgeon General, U.S. Navy to the Secretary of the Navy* and in the scientific publication of his presentation made to the Fifth Annual Meeting of the Air Hygiene Foundation of America (1941) (Exhibit H), discussed the findings of his medical survey at the New York Navy Yard. Captain Brown, recognized as the founder of the Navy's formal occupational health program, assessed asbestos exposure and medical findings at the New York yard of eleven workers. With knowledge of occupational exposure to silica and its delayed medical findings, and under the conditions that he observed, Captain Brown found no indication of pulmonary disease in these workers at that time. He noted that wet methods and local exhaust ventilation were implemented, and that the workers wore a respirator "during the dustiest aspect of the process." He stated that similar findings were reported in two other yards and recommended that the study be extended to all men in this trade. These references further demonstrate that senior Navy personnel actively monitored and controlled the Navy policy regarding disease and injury prevention, and were indeed the leaders in field assessment and control of occupational health hazards, including asbestos.

11. When quantitative assessment (counting) of asbestos particles in air was available, the Navy followed the recommendations of the United States Public Health Service. Based upon

the findings of Dreessen and coworkers' study (1938) (Exhibit I) of asbestosis in the textile industry prepared by direction of the United States Surgeon General, the United States Navy accepted an exposure level of 5 million particles per cubic foot (5 MPPCF) as the time-weighted average (TWA) for occupational exposure. Dreessen et al. concluded: "It would seem that if the dust concentration in asbestos factories was kept below 5 million particles (the engineering section of this report has shown how this may be accomplished), new cases of asbestosis would probably not appear." This TWA is the average airborne concentration of asbestos particles to which an individual could be exposed in an eight hour period. Shorter periods of higher concentrations were acceptable as long as the average exposure calculated over eight hours did not exceed the TWA.

12. In a 1941 memorandum to the Surgeon General, the Chief, Division of Preventive Medicine (Stephenson, 1941) (Exhibit J) addressed the policy of inviting the Bureau of Labor Standards or the United States Public Health Service into the Navy yards for the purpose of surveying welding and other hazards. Commander Stephenson wrote:

> "I told Mr. Bard (Assistant Secretary of the Navy) that this was not considered the best policy, due to the fact that we had medical officers in the Yards and that in practically all instances recommendations of sound character had been made by medical officers. We saw no need of inviting the United States Public Health Service on its own invitation to do this job. Likewise, I told him that I had spoken to you and that you had indicated that President Roosevelt thought that this might not be the best policy, due to the fact that they might sense disturbance in the labor element."

Under "*Points of great interest*," Commander Stephenson expressed concern about silicosis, sand blasting, welding, solvents, hydrogenated (sic) hydrocarbons, eye flashes, cadmium dust, smokes and fumes, chromium trioxide, and asbestosis. With respect to asbestos, he stated:

> "We are having a considerable amount of work done in asbestos and from my observations I am certain that we are not protecting the men as we should. This is a matter of official report from several of our Navy Yards."

13. As found by Captains Jenkins and Brown, there were asbestos exposure conditions that were not fully satisfactory and required changes. Recommendations for correction of the exposure conditions were made. In both of these instances, only a qualitative assessment was

made and actual exposure levels were not determined. Brown (1941) found no significant clinical findings in the limited number of workers observed during the relatively short, post-exposure period. The Navy's occupational health program was based upon internal support for the identification and control of occupational health hazards. In order to develop a sufficient cadre of physicians and scientists, the Navy developed training programs with Columbia University's DeLamar Institute of Public Health and the Harvard School of Public Health. By the end of World War II, over one hundred physicians, scientists, and engineers had been trained in occupational health at these two leading institutions of US public health.

14. The *Minimum Requirements for Safety and Health in Contract Shipyards* (Exhibit K) was drafted in 1942 by representatives from labor management committees, labor unions, management of private shipyards, insurance companies, the United States Maritime Commission, and the United States Navy. When approved by the US Maritime Commission and the US Navy in early 1943, compliance with these standards was expected:

> "Each contractor is hereby given notice that the Navy Department and the Maritime Commission will expect full and complete compliance with the minimum standards which bear the approval of the Navy Department and Maritime Commission, and each is requested to give full cooperation to the consultants on health and safety who will be charged with the coordination and supervision of the safety and health program of the two agencies.
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> H-13. A Guide for Prevention of Industrial Disease in Shipyards
>
> 13.1 Eight common types of disease and methods for their prevention are given in the following sections. Help in applying these methods will be given by the local Safety Department and by safety and medical consultants of the Navy Department and the Maritime Commission.
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> . . . .
>
> 13.7 Asbestosis
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> a. Sources: In general, any job in which asbestos dust is breathed. For example:

| ***Job:*** | ***When Material Is:*** |
|---|---|
| *Handling* | *Asbestos* |
| *Sawing* | *Asbestos mixtures* |
| *Cutting* | |
| *Molding* | |
| *Welding rod salvage* | |

b. Job can be done safely with:

1. Segregation of dusty work and,

2. (a) Special ventilation: hoods enclosing the working process and having linear air velocities at all openings of 100 feet per minute, or

   (b) Wearing of special respirators.

3. Periodic medical examination"

Less than six months after the Minimum Requirements were issued, the Secretary of the Navy (Forrestal, 1943) (Exhibit L) reaffirmed these requirements for all private shipyards having Navy contracts. The minimum requirements did not provide a specific occupational exposure value for asbestos. They gave general requirements for safe (healthful) operations. The Navy's occupational health team was responsible for assisting in interpreting the standards for implementation at Navy and contract yards throughout the country. Any significant inspection findings, whether favorable or adverse, were to be discussed first with the shipyard management, thus allowing management the opportunity to take corrective action for imminent dangers. The actual written report was to be submitted in draft form to the regional director of the Maritime Commission for final typing. (Exhibit M)

15. In addressing exposure to asbestos, Philip Drinker, then Chief Health Consultant for the United States Maritime Commission, and Professor in the Harvard School of Public Health program that was training the Navy physicians, scientists, and engineers, recommended an occupational exposure level of 5 MPPCF. (Drinker, 1944) (Exhibit N). This is the same value as recommended by Dreessen and coworkers (1938) to prevent the development of asbestosis.

16. In January 1945, Philip Drinker (1945) (Exhibit O) informed Captain T. J. Carter, Bureau of Medicine and Surgery, of a serious health risk from asbestos dust exposure at the Bath Iron Works. He was concerned that similar risks might be found in other yards where the same type of pipe covering was used. In this letter, Professor Drinker stated that the manufacturers of the asbestos materials used at Bath would:

" … be glad to get out a brief statement of precautions which should be taken in

> light of their own experience and that they would inform their competitors that I had asked them to do so. I understand that neither the Navy nor Maritime wants any change in the specifications as the performance with the present materials is entirely satisfactory. From a health standpoint we do not believe any specification changes are needed."

Drinker recommended that a study be performed to evaluate asbestos exposure and disease among workers. "Admiral Mills agreed that such studies would be wise before Navy or Maritime accepted this asbestosis risk as being significant in our general ships construction program." Four shipyards in the New York area, two contract and two US Navy yards, were selected for this study of exposure levels and health status. The study, conducted by Fleischer, Viles, Gade, and Drinker--also called the Fleischer-Drinker study--was promptly undertaken and reported in September, 1945 (Fleischer, 1945) (Exhibit B). The results of this study reaffirmed the Navy's position on adherence to an occupational exposure level of 5 MPPCF. The conclusions were:

> "1. The character of asbestos pipe covering on board naval vessels is such that conclusions drawn from other asbestos industries such as textiles, cannot be applied.
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> 2. The operations of band saw cutting, grinding, cement mixing, and installation aboard ship should be equipped with exhaust ventilation to keep the total dust concentration low.
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> 3. The incidence of asbestosis among pipe coverers in the shipyards studied was low, 0.29 per cent or 3 cases out of 1074.
>
> 4. Since each of the 3 cases of asbestosis had worked at asbestos pipe covering in shipyards for more than 20 years, it may be concluded that such pipe covering is not a dangerous trade."

17. The Fleischer-Drinker study was a well-designed study which measured actual asbestos exposure values and performed health assessments on the exposed workers. It was recognized, even at the time of this study, that the ability to detect physiologic changes in workers which occur only after a period of delay would be limited by the intensity (concentration) and duration (period from onset) of their exposure. The results of the Fleischer-Drinker study became established as Navy policy. The Navy adopted a recommended "maximum allowable concentration (M.A.C.)" value for asbestos of 5 MPPCF. This was the same value discussed by Dreessen and coworkers (1938) when assessing the asbestos textile

industry with much longer daily exposure periods and primarily the chrysotile type of asbestos. It is also the value recommended by the National Conference of Governmental Industrial Hygienists in 1942, and later adopted by American Conference of Governmental Industrial Hygienists (ACGIH) in 1946 (Exhibit P). Among the members of the ACGIH in 1946, a private organization which did not offer membership to individuals affiliated with industry, were three representatives of the Navy Department and forty-two representatives from the United States Public Health Service. During this period, there were no federal, state, or local occupational exposure standards; the Navy used the occupational exposure level that was supported by the best scientific and medical evidence available. In 1955, the Navy adopted the "Threshold limit values for toxic materials" adopted by the American Conference of Governmental Industrial Hygienists as a basic reference and "to provide guidance toward the reduction of potential health hazards encountered in the industrial environment for both military and naval civilian personnel." The Navy recognized that the:

> "threshold limit values should be used as a guide in the control of health hazards and should not be regarded as fine lines between safe and dangerous combinations. The most desirable levels in all cases are those approaching zero, but practical considerations frequently require the acceptance of higher levels which are safe, but not ideal."

Moreover, the Navy recognized that the:

> "...threshold limit values ... are based on the best available toxicological information, long-term industrial experience, and experimental studies. In as much as these values are constantly being reevaluated, revisions or additional will be made as further information becomes available."

(Chief, BUMED, 1955) (Exhibit Q).

18. On January 7, 1958 the Department of the Navy issued its *Safety Handbook for Pipefitters* (Exhibit R). This handbook was one of many safety handbooks issued by the Navy as an aid in safety indoctrination and accident prevention. That handbook provided, in part:

> "Asbestos. Asbestos dust is injurious if inhaled. Wear an approved dust respirator for protection against this hazard."

19. In the 1960 publication of *Safety and Health Regulations for Ship Repairing*, the Department of Labor recommended an occupational exposure level of 5 MPPCF for asbestos.

For comparison to the degree of risk and hazard, the Department of Labor also used the occupational exposure level of 5 MPPCF as the same absolute value for high "free" crystalline silica dust (greater than 50% free silica). The silica value is also the same value established by the ACGIH in 1942 and promulgated in 1946.

20. The use of the 5 MPPCF level as the occupational exposure value continued to be generally accepted by professionals practicing occupational health in the United States. This value was based upon controlling the development of the fibrotic disease, asbestosis. This occupational exposure value, and the widespread use of asbestos, continued in the Navy until the late 1960s when the scientific and medical communities (Selikoff 1965, 1967) (Exhibit S) and the United States Navy (Commander NAVSEC, 1969; Officer-in-Charge NAVSEC Philadelphia, 1969) (Exhibit T) had evidence that it was not sufficient to adequately control the health effects of exposure.

21. Selikoff, in a paper written with Lee in 1979 (Lee, 1979) (Exhibit U), wrote:

> "What's past is prologue!" The decade of the 1960s provides a convenient time at which to terminate a historical view of asbestos disease. With admirable hindsight from the late 1970s we can see that the essential evidence had already been reported, but not yet assembled or vested with sufficient credibility to be entirely convincing. With few exceptions, the evidence at that time rested on scattered reports of small numbers of cases, and the cases themselves suffered from being either selected or simply those that happened to come to the attention of the reporter. The population base from which the cases came was seldom mentioned. The significance of pleural changes and the occurrence of mesothelioma in persons without a distinct history of exposure remained in considerable doubt. The idea that asbestos could be at least a cofactor in the production of bronchogenic carcinoma was far from fully accepted. That parenchymal asbestosis was very likely to occur in those who had been exposed to heavy dosage in the early years of the industry was clear enough, but what effect environmental controls that had been introduced in the late 1930s might have upon its future prevalence was unknown. The possibility that quite low dosages might have grave consequences 30 or more years after first exposure was still unproven."
>
> "Many things were needed to confirm the suggestions that were emerging from the studies up to that time. Most importantly, systematic epidemiologic investigation was needed of large cohorts drawn from various types of industry, with the inclusion of adequate control populations. Some of these were already organized, but it was too early for the results to be meaningful. We now know that much of the negative evidence stemmed from coming to conclusions prematurely, before the slow processes of carcinogenesis had had a chance to make themselves evident. We now know also that reduction of heavy exposures that lead to early death would reveal such slowly developing diseases as mesothelioma and bronchogenic carcinoma with increasing clarity. But foreknowledge was not

> available at the time, although some investigators suspected that the auguries were not good. More sophisticated and sensitive ways of recognizing the disease processes at an early stage, before the appearance of marked radiographic changes, were badly needed. A series of international conferences, some already in the planning stages, were to accelerate these developments greatly. Those who felt that it was an exciting time were not to be disappointed. The excitement has not even yet been entirely dissipated."

22. Captain N.E. Rosenwinkel, representing the Navy's Bureau of Medicine and Surgery, provided information regarding the Navy's knowledge of asbestos hazards to shipyard employees for inclusion in a statement issued by Rear Admiral J.J. Stilwell of the Shipyard Management Directorate, Naval Sea Systems Command in 1968 (Rosenwinkel, 1968) (Exhibit V):

> "The United States Navy is well aware of the hazards of asbestos to its employees engaged in ship construction and ship repair at naval shipyards. Hazard control measures implemented by the shipyard medical departments and safety divisions are in accordance with accepted standards of industrial hygiene practices in the United States. Stringent efforts are directed at keeping the concentration of airborne asbestos dust below the level recommended by the American Conference of Governmental Industrial Hygienists. An energetic periodic physical examination program insures the health of personnel exposed to this hazard."

23. During the period of the late 1960s, asbestos exposure and control were being addressed at different levels of command throughout the Navy. The Naval Ship Engineering Center was searching for substitutes that could meet the rigorous engineering requirements for shipboard applications (NAVSEC, 1969). A meeting between senior engineering, safety, and medical personnel was held to evaluate possible methods for reducing exposure and to make recommendations to the Chief of Naval Operations (Turnbull, 1969) (Exhibit W). Major Navy shipyards were sharing their research on asbestos exposure and control measures (Mangold, 1970) (Exhibit X).

24. It was not until 1970 that the Occupational Safety and Health Act (PL 91-596) (Exhibit Y) established national permissible exposure levels (PEL) for the first time using the federal standard established under the Walsh-Healey Public Contracts Act. These standards applied to shipyards, as well as other industries using asbestos. At the time of enactment in 1971, the PEL for asbestos was 12 fibers per cubic centimeter (f/cc). Based upon current

scientific and medical recommendations by that time, the Occupational Safety and Health Administration (OSHA) emergently lowered the PEL to 5 f/cc (ceiling value of 10 f/cc) in 1971, with a permanent standard of 2 f/cc becoming effective in 1976. In 1975, OSHA recognized sufficient medical and scientific evidence of human carcinogenicity to reduce the permissible exposure level to 0.2 f/cc. After legal challenges, OSHA reduced the PEL to 0.2f/cc in 1986, and further reduced it to its current value of 0.1 f/cc in 1994. Requirements from the highest levels of authority in the United States Navy established the permissible exposure levels as they changed during this post-OSHA era (NAVSHIPS, 1971 (Exhibit Z); BUMED, 1973 (Exhibit AA); OPNAV, 1974 (Exhibit BB)).

25. The Navy has continued to follow the policy of using occupational exposure levels based upon the best available scientific and medical information (Chief BUMED, 1955). The federal PELs, established by the Occupational Safety and Heath Act of 1970, are generally based upon the American Conference of Governmental Industrial Hygienists' Threshold Limit Values (TLVs) published in 1968. Due to statutory requirements, changes to the limited number of chemical PELs have generally been slow. PELs have been changed for a relatively few chemicals since the enactment of OSHA in 1970. The non-statutory, "recommended" TLVs are periodically reviewed and an updated list is published annually for use by industrial hygienists in their professional assessment of occupational exposures. The TLVs more closely reflect the current state of knowledge and professional practice in occupational health. The Navy continues to use the most appropriate occupational exposure level in the assessment of exposures and follows the requirements stated in the Chief of Naval Operations Instruction OPNAVINST 5100.23F (Chief of Naval Operations, 2002) (Exhibit CC) to provide workplaces that reflect the state-of-knowledge and technology, consistent with its defined mission:

> "The maintenance of a safe and healthful workplace is a responsibility of commands throughout the Navy. A successful Navy Occupational Safety and Health (NAVOSH) program, one that truly reduces work-related risks and mishaps, results only when support and commitment to the program permeate every level of an organization. Within the Navy, the Chief of Naval Operations (CNO) has overall responsibility for the NAVOSH program and implements the program through the chain of command. Line management is responsible for the maintenance of safe and healthful working conditions."

26. Based on my education, training, and experience, it is my professional opinion that the Navy was well aware of the health hazards associated with the use of asbestos from the early 1920s. The Navy's decision to use asbestos materials was based upon naval operating requirements and missions in light of the known health hazards at the various periods of time. The Navy had a longstanding and notable occupational safety and health program that addressed asbestos and other health hazards, and that provided exposure control recommendations and methods that were consistent with the state-of-the-art knowledge in science and medicine. The Navy operated under the premise that control of asbestos exposure could essentially eliminate the hazard of a material considered essential for sustained Navy operations. Using established scientific and medical knowledge, the Navy developed an active program to control the release of asbestos fibers in dusty operations, as well as, to monitor the health of workers at risk. The landmark study of Fleischer-Drinker, reported in 1945, confirmed the general thought that exposures in the Navy to asbestos containing materials could be controlled and health effects could be limited by medical surveillance. Navy industrial programs were directed at controlling what was considered significant releases of dust. During the period from about 1938 through the later 1960s, the widely accepted occupational exposure limit was 5 MPPCF. In the mid-to-late 1960s, the Navy led the way in assessing asbestos exposure of personnel and developing a program and process to eliminate the material based upon new scientific and medical information that was becoming available.

27. The information possessed by the Navy, with respect to the specification and use of asbestos, and the health hazards associated with its use aboard Navy vessels, far exceeded any information that possibly could have been provided by a turbine manufacturer. Additionally, the turbine manufacturer had absolutely no responsibility or control over the operating workplace or personnel--both essential aspects of hazard communication. Concomitant with the huge increase in shipbuilding of World War II, the Navy developed a robust and multi-faceted occupational health program which addressed many health risks. Over a quarter-of-a-century before the enactment of the Occupational Safety and Health Act of 1970 (OSHA, 1970; PL 91-596), the

Navy had an asbestos control program in place which contained much of what was later required for NON–military workplaces under this first national legislation controlling occupational exposure to asbestos. The Navy's program far exceeded the mere provision of a warning placard or note in an instruction or operation manual. The major aspects of the Navy asbestos control program existed before OSHA and have continued, with modifications, to remain consistent with the evolving state-of-the-art (SOTA) knowledge and statutory requirements of OSHA. The Navy's early program included the: (1) adoption of an occupational exposure level (five million particle per cubic foot (5 MPPCF); (2) establishment of the methodology to evaluate exposures; (3) training and equipping an occupational health team with state-of-the-art knowledge and equipment; (4) development and specification of engineering and administrative controls where required; (5) establishment of a proactive medical surveillance program applying SOTA monitoring techniques (incorporating pulmonary function testing to detect early changes with greater sensitivity than using chest radiographs alone (chest radiographs reveal later-developing changes)); the wearing of respiratory protection for tasks performed when exposure levels were expected to exceed the accepted ,"time-weighted" concentration; (6) recordkeeping, and (7) training. The Navy used the accepted occupational exposure level of 5 MPPCF before the enactment of OSHA. After OSHA was enacted, the permissible exposure level (PEL) was established as 12 fibers per cubic centimeter (f/cc) in 1971. This initial PEL was reduced to 5 f/cc later that year, and then 2 f/cc in 1976. In accordance with OSHA rulemaking process, the PEL was reduced to 0.2 f/cc in 1986, and then to the current level of 0.1 f/cc in 1994. The last feature included in the Navy's asbestos control program, namely worker training, was not specifically addressed in the 1972 OSHA asbestos standard. It must also be noted that the Occupational Safety and Health Act did not apply to Executive Branch Departments. However, it was extended to "non-military unique" federal workplaces under Executive Order 11612. It is obvious that the addition of a simple warning by an equipment manufacturer--especially one addressing an additional product, which may or may not have been used in conjunction with a supplied piece of equipment--was not only unnecessary, but would be inherently disruptive in a

military setting. If an equipment manufacturer was required to warn about the possible composition of the thermal insulation which could be applied, should the equipment manufacturers also have been required to address lead-based paint, fuel components (polynuclear aromatic hydrocarbons), feedwater additives, "stack gas" (exhaust) emissions, and even the hazards presented by the enemy, the sea, and the nutritional content and food value of their Navy-provided diet?

28. The Navy controlled exposure to asbestos consistent with the then current state of accepted scientific and medical knowledge balanced by needs for national defense. Sailors did not have the option to avoid exposure to asbestos-containing products or environments in which asbestos was used while on active duty. Certainly, Navy vessels built and overhauled in the 1940 through 1960 period contained large amounts of asbestos which covered steam-driven equipment and thousands of feet of thermal-insulated pipes. These insulated lines traversed the entire vessel including non-engineering work spaces, as well as eating and berthing spaces.

29. The Navy's knowledge regarding the applications of asbestos and the health effects represented the state of the art. During the period from the early 1920s to the late 1960s, there was nothing about the hazards associated with the use of asbestos-containing products on a marine steam turbine on United States Navy ships known by a turbine manufacturer, like General Electric Company, that was not known by the United States and the United States Navy. In light of the Navy's knowledge regarding the potential asbestos-related health hazards from exposure since the 1920s (well before the large increase in specification by Navy designers, architects, and engineers), and the known military and technologic benefits or advantages afforded by the use of asbestos as thermal insulation and in other applications, the Navy made an informed decision to use asbestos-containing products. The Navy was fully cognizant of potential health hazard when it specified use of asbestos in applications critical to national defense and the conduct of war. To insure that the health of its military and civilian personnel was maintained, the Navy established a sound, premier SOTA occupational health program to control the recognized, potential health hazard. To carry the concept involving the offering of a written warning by an equipment

manufacturer further, as the Navy had determined what an "acceptable asbestos exposure" was, the Navy would not, nor could not, allow each sailor to make an additional determination of what constituted an acceptable exposure on an individual basis. This is not only true for determining whether or not one would accept an asbestos exposure, but also all of the dozens of daily exposures (including the enemy) that confront military personnel.

30. A further question has been asked of me as to whether Navy specifications or instructions support the notion that manufacturers of equipment such as Navy steam turbines were free to provide additional warning information about hazards associated with products that they did not manufacture or supply. Based upon review of many documents regarding the Navy's hazard communication program, including documents such as MIL-M-15071C (10 September 1957)(Exhibit DD) and Navy instructions such as SECNAV Instruction 5100.08 ("Uniform Labeling Program - Navy, 26 September 1956)(Exhibit EE), and based on my career experiences as an Industrial Hygiene Officer and a physician in the Navy dating back to 1972, and personal knowledge of the Navy's hazard communication program and Naval practices generally, I can state as follows:

a. Uniformity and standardization of any communication, and in particular safety information, are crucial to the operation of the Navy. The Navy had a sound, occupational health and safety program based upon its requirements and conducted in accordance with Navy regulations, instructions, and operational necessities. Simply, the Navy could not operate if various personnel were trained differently and received additional, inconsistent information from different manufacturers.

b. For example, SECNAV Instruction 5100.8 -- which is an internal Navy directive from the Secretary of the Navy directing Navy personnel, not manufacturers of material or equipment, of the manner in which to carry out their obligations -- Para.1 states:

> "The purpose of this Instruction is to standardize labeling requirements for hazardous chemical products during usage . . ."

c. Any additional warning about the hazards of asbestos by an equipment manufacturer would be only partial in scope, as well as inherently redundant and possibly inconsistent with the Navy's own position and training. In the heat of battle, there is simply no time to be interpreting inconsistent hazard labels.

d. What would a warning have provided? It has been my understanding, which has been supported by my experience, that literally all Navy sailors serving on ships in the WWII era and through the late 1960s assumed that the high temperature thermal insulation used on steam pipes contained asbestos. The exact type and composition of the thermal insulation may not have been known, but the use of asbestos for such application was so universal that identification of the insulation as asbestos-containing was often assumed—even in instances where it was replaced with fibrous glass, mineral wool, or other non-asbestos materials. This was still the practice when I was commissioned in 1972. As a fundamental aspect of Navy training and practice, dust control and a high level of general cleanliness, even in the engineering spaces, were routinely maintained as part of the Navy shipboard environment.

e. At best, an equipment manufacturer such as General Electric, which delivered "bare metal" turbines could merely have told personnel to follow the Navy's own mandates for handling asbestos. Potentially redundant information is not informative, and diverts attention from hazards inherent in the equipment, and would certainly become obsolete. For example, the life expectancy of a propulsion turbine is many years, while military specifications and program emphasis (such as the Navy's asbestos hazard communication program) change much more frequently and have evolved over the years to keep pace with scientific developments and changes in materials.

f. There is a sound reason why the Navy did not want unsolicited and potentially inconsistent warning information from equipment manufacturers regarding asbestos insulation (or any other product) which was provided by other vendors or

contractors. If every equipment manufacturer (and conceivably even the pipe and structural steel manufacturers) provided its own warning about asbestos insulation that might be used on or around its product, inconsistent warnings from these various sources would certainly have resulted. And, keep in mind, many other hazardous substances (e.g. boiler feed water chemicals, fuels, solvents, heavy metals) are used in conjunction with the multitudes of equipment on a ship. If each was to warn about all the possible substances that might be used on or around its equipment, sailors would quickly become inundated with inconsistent information on a myriad of substances.

g. Some types of insulation used by the Navy on equipment were non-asbestos (e.g., fiberglass blankets) and any warning about asbestos on such equipment would simply be wrong. How could an equipment vendor know what insulation material would be used in a specific application? Military specifications for thermal insulation allow an assortment of materials—as determined by a number of critical design and materiel availability parameters. As early as 1952, MIL-I-16411A addressed a thermal insulation felt that was suitable for use on steam turbines and other machinery and equipment operating at temperatures to 1,200oF -- if selected by the naval design engineers and builders. After delivery of the equipment, how would a supplier know what insulation material would be used in future repairs, overhauls, and conversions made one, two, or more decades in the future?

h. MILSPEC-M-15071D, Para. 3.3.1 makes it clear that equipment manufacturers' manuals must first be approved by the Bureau of Ships and the "manual shall not be modified without approval of the Bureau of Ships." Moreover, it cautions:

> "Notes, cautions, and warnings should be used to emphasize important critical instructions. The use should be as sparing as is consistent with real need."

This specification applies to risks inherent in the operation of the equipment. Unsolicited and gratuitous warnings about the possible use of materials made by others do not comport with this specification. Any suggestion that General Electric was free to depart

from Navy-approved manuals is incorrect.

31. Lastly, but importantly, General Electric was an equipment manufacturer and not a subject matter expert regarding the health effects or industrial hygiene controls associated with the use of asbestos-containing insulation materials in naval applications. It is unreasonable to assume that the Navy would have accepted "helpful comments" from a vendor or equipment manufacturer concerning a material or substance provided by another vendor or supplier in which it was not a subject matter expert. Furthermore, the Navy had this specific knowledge and more—and understood its own basis for specifying asbestos-containing products aboard ship. The Navy already had a robust and encompassing occupational health program that far exceeded just the mere labeling of a material. This program included aspects appropriate for the degree of recognized hazard at various times including training, engineering controls, medical examinations, provision of personal protective equipment, and the use of alternative products when possible.

32. The military setting is unique and distinct from the civilian environment, and although management structure is generally similar, the command hierarchy of rank is well-defined and the authority of the Commanding Officer approaches absolute. This authority is based in Federal statute, as well as in Navy Regulations and Instructions. Over time, there have been evolutionary changes in these to incorporate changing societal values, but the authority of the individual in command remains constant. When routine "orders" are given, prompt and appropriate response is expected. The failure to obey a lawful order is a punishable offense, and depending upon the situation (war time, national emergency, misconduct), the punishment can be severe. Individual freedoms that are common civilians are not as universally applied to military members. Civil liberties indeed exist, but they are tempered to the strict Uniform Code of Military Justice (UCMJ) and the requirements of individuals serving in the Country's national defense. Personnel are told what to wear and how to wear it. They are told when to rise in the day, and when to eat. Military members ask for permission to leave the presence of a senior in a formal setting, and juniors initiate salutes when in uniform. Even though the actual work tasks

and duties may be identical, military personnel are not civilians "just doing a job".

Therefore, I conclude:

(1) The information possessed by the Navy with respect to the specification and use of asbestos, and the health hazards associated with its use aboard Navy vessels, represented the state-of-the-art and far exceeded any information that possibly could have been provided by a turbine manufacturer, like General Electric. Based upon the knowledge available at a given period in time, the Navy was fully aware of the recognized health hazards of asbestos and had a robust program to control exposure of personnel and monitor their health.

(2) As the Navy had a premier program in occupational health and understood the military necessity underlying its specifications, there was no information concerning any asbestos-containing hazard or danger posed by any asbestos-containing product applied to any marine turbine on a United States Navy ship known to a turbine manufacturer, like General Electric Company, that was not known to the United States and the United States Navy.

(3) It would be unreasonable to assume that the Navy would have accepted unsolicited and gratuitous comments from equipment manufacturers about hazards associated with a product it neither made nor sold and about which the Navy was already aware.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

Executed on the 24th day of February, 2008, in Poquoson, Virginia.

Lawrence Stilwell Betts, MD, PhD